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ORIGINAL ARTICLE

Posterior reconstruction and anterior suspension with single anastomotic suture in robot-assisted laparoscopic radical prostatectomy: a simple method to improve early return of continence

Jonathan F. Kalisvaart · Kathryn E. Osann · David S. Finley · David K. Ornstein

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Abstract Post-prostatectomy urinary incontinence is a major cause of morbidity from radical prostatectomy. Efforts have been made to develop techniques to hasten return of urinary control. Several authors have demonstrated improved early continence with anterior, posterior, or combined reconstruction of the urethral–pelvic attachments. In this study, we compare three-month urinary function and continence data for patients who underwent RALP with posterior reconstruction and anterior suspension with single anastomotic suture (PRASS). A prospective cohort of 50 patients underwent RALP with PRASS reconstruction and were compared to 50 control patients who underwent standard RALP. Continence was defined as use of 0–1 urinary pads and was evaluated at each follow-up visit using the EPIC-26 questionnaire. A weighted summary score was created and group differences were compared using a repeated measures analysis of variance model. After adjusting for age, baseline AUA symptom score, and SHIM scores, which were found to correlate with continence, patients who underwent the PRASS reconstruction had significantly improved urinary control at three months compared with the control group; 90.9% of the patients in the PRASS group wore 0–1 pads per day versus 48.2% in the control group ($P = 0.014$). Of the patients undergoing the standard prostatectomy 20.6% were totally pad-free compared with 42% of the patients undergoing the PRASS procedure ($P = 0.042$). In conclusion, the PRASS technique resulted in statistically significant improvement in urinary control three months post-operation. The PRASS reconstruction is technically straightforward, requires no additional sutures, and is a simple technique that is easily learned and adaptable to other robotic surgery.

Keywords Robotics · Prostatectomy · Urinary incontinence

Abbreviations

BMI	Body mass index
EPIC	European prospective investigation into cancer and nutrition
RALP	Robotic assisted laparoscopic prostatectomy
SHIM	Sexual health inventory for men

Introduction

Short-term urinary incontinence is a major cause of morbidity associated with both the open and standard robotic/laparoscopic radical prostatectomy. Although fewer than 5–10% of patients have long-term effects after one year, the incidence of early post-operative incontinence varies widely, with 44–76% of patients requiring two or more pads per day at three months [1–3]. Despite the transient nature in most cases, quality-of-life studies have revealed that short-term incontinence is severely bothersome to most men [4]. Recent studies have attempted to preserve early continence by anatomically restoring the urethral–vesical

J. F. Kalisvaart · D. S. Finley · D. K. Ornstein
Department of Urology, University of California, Irvine Medical Center, Orange, CA 92868, USA
e-mail: jonkalisvaart@gmail.com

K. E. Osann
Department of Medicine, University of California, Irvine Medical Center, Orange, CA 92868, USA

D. K. Ornstein (✉)
Vanguard Urologic Institute, Memorial Hermann Medical Plaza, 6400 Fanin St., Suite 2300, Houston, TX 77030, USA
e-mail: jonkalisvaart@gmail.com

junction [5–9]. Although early data suggests that some of these techniques may improve early urinary control, some are technically demanding and may prolong operative times for less experienced surgeons. The most effective and efficient method to improve early return of urinary control following RALP remains to be established.

In an effort to improve short-term urinary control we developed a simplified approach to combined posterior reconstruction and anterior suspension using a single anastomotic stitch (PRASS). Herein, we prospectively evaluated recovery of urinary control in a single-surgeon-series of patients undergoing PRASS and compared them with a cohort who underwent standard RALP.

Materials and methods

Following approval from the UCI Internal Review Board, data were collected prospectively by patient reported self-administered questionnaires obtained during preoperative and three month post-operative visits following RALP. All cases were performed by a single surgeon (DKO) between November 2003 and May 2008. In the first 231 procedures the urethral–vesical anastomosis was completed using the standard Van Velthovan stitch as previously described [10] without any additional anti-incontinence procedures. In July of 2007, the PRASS modification was introduced. Fifty consecutive patients were evaluated (case #275–324) and compared with 50 consecutive patients who underwent standard RALP (control group; case #182–231). Baseline patient characteristics are shown in Table 1. At three months, follow-up data were available for 39 patients (78%) in the control group and 35 patients (70%) in the PRASS group. Follow-up data were not available for 11 control and 15 PRASS patients because these patients had returned to their local urologist for follow-up care. There was no significant difference in baseline characteristics of the patients with and without three month follow-up data.

Statistical analysis

EPIC summary score

Baseline patient characteristics (age, AUA symptom score, SHIM score, nerve sparing procedure, BMI, prostate weight, positive surgical margin rate) were analyzed to assess for preoperative differences between groups (Table 1). Continence was defined as using 0–1 pads per day. Post-operative continence was evaluated by using questions 1–5 from the EPIC-26 questionnaire:

1 "Over the past 4 weeks how often have you leaked urine?"

Table 1 Baseline characteristic of (a) patients with and without three months follow-up data and (b) patients in the control and PRASS groups

	Patient with 3 month follow-up data		Patients without 3 month follow-up data		*P*-Value
	N	Mean	*N*	Mean	
(a) Age (years)	72	63.5	28	62.3	0.45
BMI	66	28.2	27	28.4	0.79
Prostate volume (cc)	58	52.9	21	50.4	0.66
SHIM—pre-surgery	71	19.7	28	18.6	0.64
AUA SS—pre-surgery	71	9.7	28	11.6	0.32
EPIC—sum at baseline	72	7.6	24	6.9	0.36

	Control	PRASS	*P* value
(b) Age (years)	63.8	62.6	0.41
BMI	29.8	28.6	0.53
Prostate volume (cc)	53.0	51.4	0.75
Pre-surgery SHIM	20.5	18.3	0.32
Pre-surgery AUASS	10.7	9.8	0.57
Pre-surgery EPIC sum	7.6	7.3	0.64
Nerve sparing (%)	70	70	1.0
Positive margins (%)	11.6	12.5	0.9

2 "Which of the following best describes your urinary control during the last 4 weeks?"

3 "How many pads or adult diapers per day did you usually use to control leakage?"

4 "How big a problem if any has dripping or leaking urine been for you during the last 4 weeks?"

5 "Overall, how big a problem has urinary function been for you during the last 4 weeks?"

A weighted summary score was created from these five items. All responses were scored from a low of one for a favorable response (e.g., no problem) to a high of four or five for an unfavorable response (e.g., significant problem). Response codes were thus reversed for questions 1 and 2 and modified to range from 1–4 and 1–5 for questions 3 and 4a, respectively, rather than 0–3 or 4. A weighted sum of all responses was calculated so that the highest score (4 or 5) received equal weight for each question. Summary scores ranged from a low of 5.5 to a high of 25. Correlations between items were high, ranging from 0.46–0.86. Cronbach's alpha for the summary score was 0.89 indicating high internal consistency.

Data were compared between groups at baseline and at three month follow-up using two-group *t*-tests for continuous variables and Pearson's chi-squared tests for categorical variables. Unadjusted EPIC summary scores were compared between groups using two-group *t*-tests. To adjust for

possible baseline differences in individuals and to adjust for co-variables independently associated with return to continence, repeated measures analysis of variance model was used. EPIC summary score at baseline and at three month follow-up were used as the within-group repeated measure. Independent covariates which are constant across trials included age, nerve sparing, baseline AUA symptom scores, and SHIM scores. A significant difference between surgical groups in the time by group interaction reflects a difference in the change in continence over time between the two groups.

Using a repeated measures analysis of variance model, we tested for differences between surgical groups in change in continence from baseline to the three month follow-up time point. EPIC summary score was the within-group repeated measure and surgical procedure was the grouping factor. Age, pre-surgery AUA symptoms scores, and pre-surgery SHIM scores were found to be significantly correlated with continence at three months as assessed using the EPIC summary score. Thus these covariates were included in the final repeated measures model to increase precision and adjust for any initial imbalances between groups related to these factors. Nerve sparing, BMI, and prostate volume were not significantly correlated with continence at three months and were excluded from the multivariate and repeated measures model.

Results

After adjusting for age and baseline AUA symptom score and SHIM score, subjects who received the PRASS procedure had significantly better urinary control at three months. 90.9% of patients in the PRASS group required one or fewer pads per day compared with 48.2% in the control group ($P = 0.014$, Table 2). Of patients undergoing RALP with the PRASS procedure 42% were pad-free at three months compared with only 20.6% of patients undergoing standard RALP ($P = 042$).

The unadjusted EPIC score at three months was not statistically different between the PRASS and RALP groups (P-value 0.96). However, when adjusted for baseline EPIC score, age, AUA symptom score at baseline, and SHIM at baseline the difference was statistically different (P-value 0.013; Table 2b).

There were no clinically significant urine leaks or early bladder neck contractures in either of the groups. In all patients the Foley catheter was removed without a cystogram on POD# 7–9. Two patients (4%) in the PRASS group developed urinary retention that resolved after reinsertion of the Foley catheter for one week. No patients in the control group had urinary retention.

Table 2 Multivariate analysis results comparing (a) 0–1 pads per day and 0 pads per day (EPIC Question 3) in PRASS and control (RALP) groups at three months post-prostatectomy after controlling for age, and baseline AUA and SHIM scores, and (b) EPIC sum score results adjusted for baseline EPIC score, age, baseline AUA symptom score, and baseline SHIM score

	Percent using 0–1 pads (%)			*P*-value
(a) Control	42.8			0.014
PRASS	90.9			
	Percent using 0 pads (%)			
Control	20.6			0.042
PRASS	42.0			
Group	*N*	Mean	SE	*P*-value
(b) Standard group (control)	34	16.0	0.89	0.013
PRASS	37	12.8	0.85	

Comments

Urinary incontinence is a major health related quality-of-life concern for patients undergoing open or robotic/laparoscopic radical prostatectomy. Immediately following a radical prostatectomy estimates of patients experiencing incontinence vary widely from 8 to 47% [2, 3]. After approximately 12–18 months the majority of these patients will have regained urinary continence [1, 11]. Despite favorable long-term outcomes, the duration until full recovery of continence is a significant concern to patients. Quality-of-life studies suggest that even early transient incontinence itself is more bothersome to patients than impotence [4].

Urodynamic studies have demonstrated post-prostatectomy incontinence to be primarily because of intrinsic sphincteric deficiency [12–16]. Multiple attempts have been made to modify Walsh's anatomic radical prostatectomy to prevent injury to, or to repair, the rhabdo-urinary sphincter. Rocco and coworkers described a technique for reconstruction of the posterior musculofascial plate and recreation of the pre-existing continuity between the Denonvilliers' fascia and the posterior rhabdosphincter. The rationale for this maneuver is to provide support to the urethra and restore it to a more anatomic position [5]. In follow-up, the group undergoing the posterior reconstruction had a significantly higher continence rate, defined as 0–1 pads per day, compared with a historical group undergoing a standard Walsh prostatectomy at 3 days (62.4 vs. 14%), 30 days (74 vs. 30%), and 90 days (85.2 vs. 46%),

$P < 0.001$. A follow-up report in 2007 also showed that this technique is feasible by a laparoscopic approach, demonstrating improvements in urinary control at 30 days, with 83.8% of patients with reconstruction having control versus 32.3% of those undergoing a standard laparoscopic prostatectomy ($P = 0.0001$) [6]. In 2008, Nguyen et al. obtained similar good results for patients undergoing either laparoscopic or robotic prostatectomy. In this series, urethral length was restored to 89% of its baseline compared with 78% without the posterior reconstruction, providing objective data to explain the improvement in continence rates [7]. In 2008 Tewari and coworkers evaluated a group of patients undergoing anterior reconstruction alone versus anterior and posterior reconstruction versus a historical control group and found that both types of reconstruction were significantly better than no reconstruction in terms of time to continence, defined as 0 pads per day or a single pad for security reasons only. At three months, the control group had a continence rate of 50% whereas the anterior reconstruction group and the combined anterior and posterior reconstruction groups had a continence rate of 77 and 91%, respectively, at three months. A much more extensive reconstruction was used in this study than that described here, with multiple interrupted sutures used to reapproximate the posterior urethral plate and a running suture used to reapproximate the arcus tendineus and puboprostatic plate to the bladder neck [8]. Interestingly, a prospective randomized study by Menon et al. in 2008 found there was no difference in early continence (<30 days) between patients undergoing RALP with periprostatic tissue reconstruction and those undergoing a standard single-layer anastamosis [9].

In this study we compared the continence rates at three months in two groups of patients undergoing RALP—one with a posterior reconstruction and anterior suspension with single anastomotic suture (PRASS) and a cohort without these modifications. Unlike previous studies with anterior and/or posterior repairs requiring extensive reconstruction and multiple sutures, we used a simplified technique using only the anastomotic sutures themselves. The posterior repair was performed by using the initial passes of the Van Velthoven suture consisting of 2 3-0 Monocryl sutures [10] to reapproximate the posterior rhabodosphincter of the urethra (Fig. 1a). Unlike the Rocco or Tewari techniques, an extensive repair was not attempted. The anterior suspension stitch was performed at the end of the urethral–vesical anastomosis. After the anastomosis was completed and tied, one of the two arms of the Van Velthoven suture was used to suspend the urethra from the posterior side of the pubic symphysis. The stitch was secured with a single Lapra-Ty (Ethicon) clip (Fig. 1b).

In our study, multivariate analysis demonstrated that, after adjusting for age and baseline AUA symptoms scores and SHIM scores, subjects who underwent PRASS repair had significantly improved urinary control at three months compared with those undergoing a standard RALP. Ninety-one percent (90.9%) of the patients undergoing the PRASS repair were using 0–1 pad per day at three months versus 48.2% in the control group ($P = 0.014$). This continence rate is comparable with that described by other groups using more extensive reconstructions, both posterior alone [6] and anterior and posterior [8]. The mechanism of improved continence with our technique is restoration of the anatomic configuration of the urethra created with the anterior and posterior reinforcement, as has been successfully done with other, more extensive reconstructions. Our

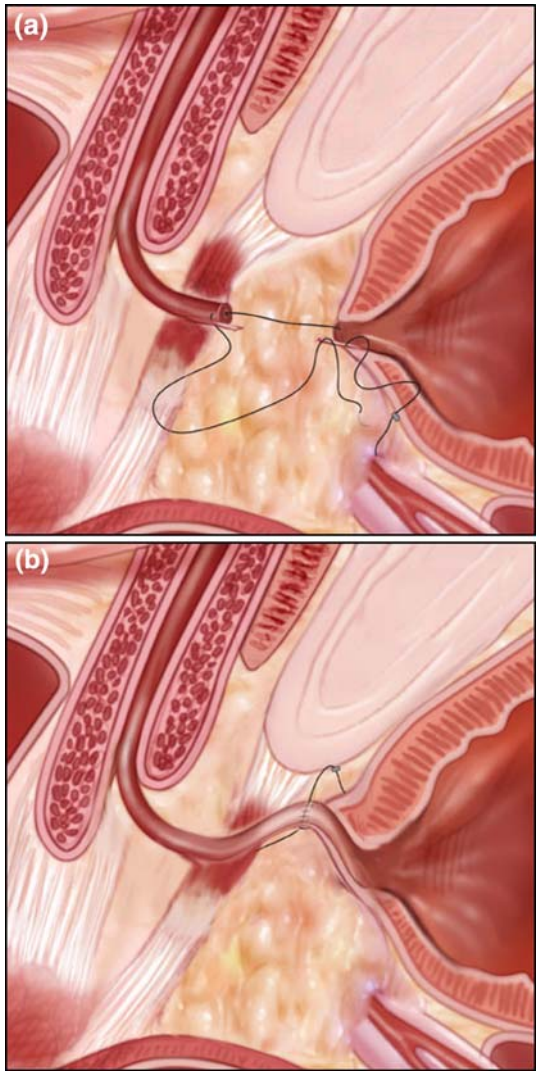

Fig. 1 Illustrations showing the PRASS reconstruction. **a** The posterior repair is performed by using the initial passes of the Van Velthoven suture to reapproximate the posterior rhabodosphincter of the urethra. **b** The anterior reconstruction is performed by using one of the two arms of the Van Velthoven suture to suspend the urethra from the posterior side of the pubic symphysis. The stitch was secured with a single Lapra-Ty (Ethicon) clip

technique also does not require multiple interrupted sutures to reconstruct the posterior urethra. This eliminates multiple knots making it simpler and therefore potentially quicker and more available to less experienced surgeons compared with similar, previously described, techniques.

A potential limitation of our study is that it is a case-controlled study rather than a prospective randomized trial. Another, potential limitation is short follow-up of only three months. We believe that three months is a relevant time point and that longer follow-up will not alter the conclusions of this report because, in general, once men regain continence following surgery they do not lose it again. Of course longer term follow-up is needed to determine the true, long term continence rate. In addition, all the men in the PRASS group underwent both an anterior and a posterior repair, making it hard to determine the impact of either the anterior or posterior stitch alone. This is similar to findings in other studies in which reconstruction of any kind was superior to no reconstruction. Men in our study have not undergone urodynamic studies which could be an objective method to measure continence, avoiding the problems inherent to any questionnaire [8]. Last, imaging studies such as MRI could be used to evaluate the impact of our repair on factors such as urethral length.

Despite these potential limitations, this technique does show considerable promise for improving the time to continence in men undergoing robot-assisted laparoscopic prostatectomy. Our technique is simple and easy to perform and has resulted in a significant improvement in continence three months following RALP.

Conclusion

We have developed a novel, simplified technique for reconstruction of the anterior and posterior support of the urethra to improve time to continence in men undergoing robotic-assisted laparoscopic prostatectomy. Patients who had posterior reconstruction and anterior suspension with single anastomotic suture (PRASS) had higher continence rates at three months using this procedure. Further study is needed to determine the different roles of these stitches.

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